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The Montreal Tramways Contract

By ARTHUR DUPERRON,
Chief Engineer, Montreal Tramways Commission.

(Before Montreal Chapter, January 21, 1932)

AT the end of the great war and shortly afterwards, nearly all street railway companies on this continent were in great financial difficulties. Wages and prices of materials had gone up considerably, and the fares for different reasons had not increased in proportion. From the beginning of the war to July 1920, 118 companies became insolvent or had gone into receivership, comprising such companies as those operating in Boston, Brooklyn, Denver, Des Moines, Toledo, Memphis, New York, New Orleans, Pittsburgh, St. Louis, etc.,—Montreal suffered like all the others and was faced with the special difficulty of operating its tramways under thirty different charters controlled by fourteen municipalities. Some of these charters were perpetual, others expired between the period of 1921 to 1961,—the most important, that of Montreal, in August 1922. In order to find a permanent solution to this intricate problem of mass transportation for the future, the two interested parties, the City and the Tramways Co., decided that an independent Commission be appointed to make a complete study of the question, and to prepare the terms of an agreement to be entered into by the two parties. The work of the commission lasted one year, studies were made of the organization of the most important transportation companies of the continent, took advice of experts, heard the representatives of the city and of the tramways co., and finally recommended the establishment of a co-ordinated service at cost. The commission prepared the terms of a contract in which is kept the principle of private ownership but subjected to the control of an independent body, called "The Montreal Tramways Commission." This contract was signed by the city and the tramways co., in January, 1918, and ratified later by the Quebec legislature.

Some of the characteristics of the contract as stated in the report of the special commissioners, are as follows:—

> "The object of the contract is to secure for the population a "system of transportation and means of communication, both "rapid and efficient. It was necessary to conciliate three dif- "ferent interests which have always been considered as directly "opposed to each other, and have caused innumerable discussion detrimental to all, viz: the interest of the municipality, "of the citizens and of the operating company. These three "bodies had to be treated with justice. A tramway system "cannot be built or expand without money, and same cannot "be obtained unless sufficient guarantee is furnished. The "system must procure sufficient revenue to assure an efficient "exploitation, and to maintain the property in good order, but "above all, it should give to the public the service they require, "and pay what it cost. A service at a low rate of fare which "does not meet the needs of the public cannot prove satisfc- "tory."

The commission consists of three members, appointed by the Lieutenant Governor in Council,—those presently in office are: Judge J. F. Saint-Cyr, Doctor-in-Law, Chairman, John S. Archibald, Architect, Vice-Chairman, and Paul Beique, Civil Engineer, Commissioner.

The commission is intrusted with the execution of the contract, it prepares the annual budget, fixes the fares, decides on the service to be given, and of additional lines, superbises the works, etc.,—It must also examine, verify and audit the company's account, said work being presently performed by Mr. Alexis Cartier, Certified Accountant, and director of the "General Accountants' Association of Montreal."

I.—Main Features of the Contract.

Let us now examine the main features of the contract.

Revenue: All revenues derived by the company from the operation of its entire system of tramways and autobuses, constitute the gross revenues, and shall be disposed of for the following purposes and in the following order.—

1.—Operating expenses and taxes.
2.—Maintenance and renewal fund.
3.—Interest on capital value of the property.
4.—Rental to the city of Montreal.
5.—Contingent reserve fund.
6.—Division of surplus.

Operating Expenses and Taxes

At the beginning of each year the commission shall fix on a basis of car-miles the alowances for the operating expenses and taxes. The commission shall also fix the average density for the year, which controls the number of miles to be run by the cars. By density is meant the number of revenue passengers per car-miles,—for instance, a density of eight means that there should be eight fares collected for each mile covered by the cars.

If at the end of the year, the commission shall find that the company has kept within the operating allowance, or shall not have exceeded same by more than 2½%, subject to conditions imposed as to density, the company is entitled to receive as an operating profit a sum equal to ⅛ of 1% on the average capital value for the year. (Said profit amounted to $65,890.00 in 1930). On the other hand, if the company shall have spent more than the operating allowance increased by 2½%, and that the company cannot prove to the satisfaction of the commission that said increase was necessary and unavoidable, the company is penalized, and the operating profit is reduced by an amount equal to said excess expenditure. If this excess is more than the operating profits, then the difference shall be paid by the company from its own money.

Any portion of the operating allowance which shall not be disbursed or needed for the expenses of the year, does not become the property of the company, but should be used with the balance of the gross revenues to pay the other charges. The company, therefore, has no interest in decreasing the service in the hope of retaining any balance of money remaining from the allowances of the year.

II.—Maintenance and Renewal Fund.

The contract stipulates that the entire plant and property of the company used and necessary to provide the public transportation service, shall at all times, be maintained at the highest practicable standard of operating efficiency. This is most important to insure the economical operation of the system. Moreover, the city has the privilege to expropriate the property at the expiration of the contract, and it is in the interest of the citizens that the property thus acquired, be modern and of real value.

To this end, the contract provides that for the purpose of maintenance, renewals, replacements and substitutions made necessary by wear and tear, age, obsolescence, etc., a certain sum, based on the number of car-miles, shall be set aside each year by the commission and placed in a fund called "Maintenance and Renewal Fund." Said fund is under the control of the commission, and no monies can be appropriated from it without its authorization. The amount in reserve in the fund shall never be less than $500,000., and in the event that the city shal acquire the property at the termination of the contract, it shall become its property.

Let us now examine the basis on which renewals, replacements, etc., are made. Rules are embodied in the contract to cover the different cases which may be summarized as follows:—

1.—Whenever any portion of the plant is renewed, or other property substituted, the cost of such renewal or substitution shall be charged to the maintenance and renewal fund, up to an amount equal to the original value of the item renewed or replaced, and any excess shall be paid out by money supplied by the company, said amount to be added to the value of the property on which the company is paid the interest fixed by the contract.

I want to emphasize the fact, that it is not possible under the contract, for the company to replace any item of property by another of greater cost without they themselves paying the difference, and you may rest assured that the company is not bettering its property at the expense of the citizens.

The company submits for approval to the commission all work orders relating to renewals, the following being given as an example:—

August 28th, 1930.

Work order covering renewal of 87 lbs. N. Construction on Delaroche St., Park Lafontaine to Mount Royal,—2,431 ft., single track using No. 1 construction, 115 lbs. rail.

Estimated Cost:	Labour	$11,900.	
	Material	16,200.	
	Total		$28,100.
Original value of track renewed		$18,017.	
Adjustment for wearing surface of roadway (not capitalized)		1,845.	
Total charge to Maintenance & Renewal Fund			$19,862.
Difference,—Charge to Capital Account			8,238.

Note: Salvage Value for material released to be credited to maintenance & renewal fund.

2.—When the original value of the item renewed, which is charged to maintenance and renewal fund, is more than the cost of renewal, then the difference is deducted from the capital value of the property, and that money is used to make additions to the property when required.

3.—When any item of property is worn out or abandoned, it shall be replaced by new property of equal value, with money appropriated from the Maintenance and Renewal Fund.

III.—Return Upon Capital Value of the Property.

Under the contract, the company places its property at the service of the public, and in return shall receive a yearly interest of 6% on the capital value of the property. The above capital value

has nothing in common with the value of the bonds, debentures, or shares of the company. At the signature of the contract, a valuation was made by a board of experts of the physical property of the company at pre-war prices, and to this value is added all money supplied by the company since, for additions, betterments, etc., authorized by the commission.

You are in a position to judge whether the interest of 6% on the value of the property is a just compensation for such a utility. You may, however, be interested to hear of a judgment rendered on this point by the Supreme Court of United States, in January, 1930, in the case of the Tramways Company of Baltimore.

It read thus:—

"It is manifest that just compensation for a utility, requiring "for efficient public service skilful and prudent management as "well as use of the plant, and whose rates are subject to public "regulation, is more than current interest on more investment. "Sound business management requires that after paying all "expenses of operation, setting aside the necessary sums for de- "preciation, payment of interest and reasonable dividends, there "should still remain something to be passed to the surplus ac- "count; and a rate of return which does not admit of that being "done is not sufficient to assure confidence in the financial "soundness of the utility to maintain its credit and enable it to "raise money necessary for the proper discharge of its public "duties.

"In this view of the matter, a return of 6.26 per cent is clearly "inadequate. In the light of recent decisions of this Court and "other Federal decisions, it is not certain that rates securing "a return of 7½ per cent or even 8 per cent on the value of "the property would not be ecessary to avoid cofiscation. But "this we need not decide, since the company itself sought from "the Commission a rate which it appears would produce a re- "turn of about 7.44 per cent. at the same time insisting that "such return fell short of being adequate. Upon the present "record, we are of the opinion that to enforce rates producing "less than this would be confiscatory and in violation of the "due process clause of the Fourteenth Amendment."

IV.—Rental to City of Montreal.

The city of Montreal shall receive annually a sum of $500,000., as a special rental for the use of the streets. Under the present system of service at cost, this rental which is paid by the users of the tramways, becomes an indirect tax. Outside of this rental, the system must pay to the city the regular taxes, half of the cost of the snow removal on the streets on which tracks are laid, and must also bear the cost of the maintenance and renewal of that part of the pavement of the street comprised in the track area, and 18 inches each side of the outside rails. With the exception of the $500,000 rental, these disbursements shall be charged to operating expenses.

V.—Contingent Reserve Fund.

A contingent reserve fund of $500,000. shall be established and maintained out of the gross revenues. This fund shall be used whenever the gross revenues for any year are not sufficient to provide for the payment of all sums payable under paragraphs 1 to 4 inclusive. However, said fund cannot be lowered to less than $300,000. Other means must then be taken to meet the deficit.

VI.—Division of Surplus.

Any portion of the gross revenues remaining after a payment of the charges described in Paragraphs 1 to 5 inclusive, shall constitute the divisible surplus, and shall at the end of the year be distributed as follows:—

To the city	30%
To the company:	20%
To the tolls reduction fund:	50%

Tolls Reduction Fund.

This fund is built up solely from monies received from the division of the surplus, and can only be used for specific purposes mentioned in the contract. When the amount in the fund shall exceed $1,000,000., the commission, if they think it advisable, may reduce the fare, and whenever it shall exceed $2,500,000., they must do so. It shall also be used to make up any deficit at the end of the year when the contingent reserve fund is less than $300,000., and shall also be used to bring this contingent reserve fund up to $500,000. No capital expenditure can be made with the tolls reduction fund. At the termination of the contract, this fund shall become the property of the city.

Administration of the Contract.

The operation of the contract can best be explained by going over an annual report of the commission. We shall use the last one issued, that of 1930.

General Statement of Revenue and Expenditures

1.—Gross Receipts		$15,352,510.53
Expenditures:—		
2.—Operating Expenses and Taxes..	$ 7,596,313.71	
3.—Operating Profit	65,889.68	
4.—Maintenance and Renewals Fund	2,534,372.08	
5.—Autobus Service Expenses	1,335,844.69	
(Interest on Capital Value	2,177,177.70	
6.—(" on Additions	880,952.07	
(" on Working Capital	7,917.53	
7.—Financing Expenses	181,431.47	
8.—City's Rental	500,000.00	
		$15,279,898.93
9.—Surplus		$ 72,611.60

The Gross Receipts of the Company serve to pay, in their prescribed order, the following: (a) Operating Expenses and Taxes; (b) Maintenance and Renewals Fund; (c) Remuneration of Capital Value; (d) City's Rental; (e) Contingent Fund; (f) Surplus.

1. Gross Receipts of the Company

Passenger Receipts (Tramways)		$13,699,780.41
" " (Autobuses):—		
Bus rates	$ 631,467.59	
Tramway rates	648,397.33	
		1,279,864.92
Freight Receipts		45,436.72
Freight Car Rental		1,079.92
Car Advertising		83,103.74
Miscellaneous Receipts (Rentals, letter-carriers' fares, etc.)		142,859.33
Unredeemed Tickets (a)		73,092.21
Interest on Contingent Fund		27,293.28
Total		$15,352,510.53

(a) Tickets sold during 1930	$13,931,100.00	
" collected during 1930.....	13,858,007.79	
Balance	$ 73,092.21	

2. Operating Expenses and Taxes

In the 1930 budget, the Commission allowed for these expenses, 26.89 cts. per car-mile for motor cars and 18.41 cts. for trailers, on a density of 7.90.

The Company having observed the density regulation, is entitled to receive the operating allowances provided for the number of car-miles, as follows:—

28,136,042 X 26.89 =	$7,565,781.70	
1,169,503 X 18.41 =	215,305.50	
		$ 7,781,087.20

Operating Expenses and Taxes:—		
Car Service	$ 4,059,144.41	
Car House Expense	296,464.29	
Tracks, cleaning and sanding	100,020.96	
Snow and Ice Expense (a)	355,836.06	
Motive Power	1,058,044.17	
Salaries, General Officers	115,012.49	
Office Salaries and Expenses	235,524.51	
Stationery and Printing	29,610.29	
Stores Expenses	76,171.09	
Miscellaneous Expenses	255,266.09	
Garage Expenses	24,148.91	
Injuries and Damages	235,038.74	
General Legal Expenses	15,440.69	
Insurance	75,967.14	
Mutual Benefit Association	169,972.16	
Taxes	465,958.16	
Freight Expenses	28,693.55	$7,596,313.71

Difference between the allowances and expenditures..$ 184,773.49

3. Operating Profit

The Company not having exceeded the above allowances, is entitled to its operating profit: $65,889.68, being ⅛ of 1% of the average value of the capital during the year: $52,711,740.95.

(a) Owing to the light snowfall, the cost of snow removal was $105,051.02 less than 1929.

4. Maintenance and Renewals Fund

The allowance for this fund was fixed by the Commission at 8.69 cts. per car-mile for motor cars and 7.64 cts. per car-mile for trailers.

28,136,042 X 8.69 =	$2,445,022.05	
1,169,503 X 7.64 =	89,350.03	
Total Allowance		$2,534,372.08
Reserve at end of year 1929		957,181.71
Interest accrued		47,366.24
		$3,538,920.03

Expenses:—		
Maintenance track and roadway	$ 242,845.94	
" electric line	104,618.80	
" buildings	60,796.46	
" stations and platforms	2,462.93	
" steam plant	23,949.40	
" electric plants	26,682.38	
" cars, body and trucks..	622,772.56	
" cars, electric equipment	386,122.01	

Miscellaneous equipment	42,912.23	
Shop expenses	75,627.08	
Renewals	784,760.57	
Total	$2,373,550.36	
Value of properties and material discarded, scrapped and deducted from Capital Value, during the year	82,629.53	
Value of properties and material discarded, scrapped and deducted from Capital Value, at the end of 1930	116,628.18	$2,572,808.07
Reserve		$ 966,111.96

5. Autobuses

Autobuses are used as auxiliaries to the tramway.

GENERAL STATEMENT	(a) Revenue	(b) Expenditure	Deficit
1. Autobuses (Bus rates)	$ 631,467.59	$ 633,206.44	$ 1,738.85
2. " (Tramway rates)	648,397.33	702,638.25	54,240.92
	$1,279,864.92	$1,335,844.69	$ 55,979.77

PARTICULARS	1. (Bus Rates)	2. (Tramway Rates)	Total
(a) Revenue:—			
Passenger Receipts	$ 629,147.45	$ 640,924.86	$1,270,072.31
Rental	20.32	21.64	41.96
Publicity	2,299.82	2,449.81	4,749.63
Sundries	.....	5,001.02	5,001.02
Total	$ 631,467.59	$ 648,397.33	$1,279,864.92
(b) Expenditures:—			
Maintenance	$ 114,605.42	$ 135,385.71	$ 249,991.13
Depreciation	127,096.52	122,079.95	249,176.47
Publicity	810.99	863.88	1,674.87
Service	301,483.56	349,280.55	650,764.11
General expenses and administration	38,510.83	41,022.47	79,533.30
Fixed charges of 6% on Capital Value	50,699.12	54,005.69	104,704.81
Total	$ 633,206.44	$ 702,638.25	$1,335,844.69

The "Autobus Depreciation Reserve" amounted to $810,946.27 on December 31st, 1930.

Capital Value		
Original Capital Value		$36,286,295.00
Additions to December 31st, 1929		14,929,105.11
Additions during 1930:—		
Track construction	$ 255,039.87	
Bonding and electric line	518,862.41	
Land and Buildings	637,601.60	
Rolling Stock	812,719.58	
Power House and Sub-stations equipment	379,238.36	

General Construction	13,581.64	
Machinery and Tools	11,736.32	
Miscellaneous Equipment	13,330.85	
Office Furniture	7,331.19	2,649,441.82
		$53,864,841.93
Value of properties and material discarded, scrapped and deducted from the Capital Value, at the end of 1930		116,628.18
Capital Value on December 31st, 1930		$53,748,213.75

6. Interest on Capital Value

The following amounts are paid to the Company, as return on its Capital Value:—

1. On the original Capital Value	$2,177,177.70	
2. On Capital additions to December 31st, 1930	880,952.07	
3. On Working Capital, as per Table No. 4	7,917.53	
Total		$3,066,047.30

7. Financing Allowance

The Company receives $181,431.47 annually, to cover the expense of procuring additional capital.

Amount allowed since 1918	$2,337,814.91
Expended since 1918	2,120,177.38
Balance	$ 217,637.53

8. City Rental

The annual rental to the City of Montreal of $500,000, has been paid.

Contingent Reserve Fund

This reserve had reached its maximum, $500,000, at the beginning of the year 1930. The accrued interest of same, 27,293.28, has been added to the gross receipts of the Company.

9. Surplus

This year's surplus is divided:—

30% to the City of Montreal	$ 21,783.48
20% to the Company	14,522.32
50% to the Tolls Reduction Fund	36,305.80
	$ 72,611.60

Tolls Reduction Fund

This account stands as follows:—

Amount carried forward	$ 400,306.75
Interest accrued	18,150.45
Proportion of 1930 surplus	36,305.80
Total	$ 454,763.00

(See also pages 176-7) Sundry Statistics—1930

(Autobuses)

Number of buses	119	
Total length of bus route	88.16	miles
Revenue bus-miles	4,559,274	
Average miles per bus	37,370	
Revenue passengers	18,050,923	
Passengers carrying transfers	7,504,750	
Bus-hours	464,395	
Operating ratio	96.19	%
Earnings per bus-mile	28.07	cts.

Expenses per bus-mile	29.30 cts.
Earnings per bus-hour	$2.76
Expenses per bus-hour	$2.88
Earnings per revenue passenger	7.09 cts.
Expenses per revenue passenger	7.40 cts.
Revenue passenger per bus-mile	3.96

It is shown by the above that it was possible up to now to meet the obligations of the contract, and at the same time give a service as good, and in many cases better than that of other important American cities using surface tramways, and this at a lower tariff as shall be noted later on.

Credit must be given to the Tramways Co., for such results. As previously stated, the contract enables the company to carry on as a privately owned concern. The company has maintained a very efficient organization, their officers are most competent, and their employees deserve the gratitude of the citizens at large for their loyalty and co-operation.

You may be interested to know the effects of the present business depression on the affairs of the tramways. I may say first that the passenger reports of the Tramways Co. reflects to a remarkable extent the economic life of our city. The depression was first felt during March, 1930, and the decrease has been gradual since.

During the year 1931, the number of passengers carried in the tramways and autobuses (transfers not included) has been as follows:—

	1929	1930	1931
Tramways	234,251,565	227,136,581	211,458,523
Autobuses	16,424,948	18,050,923	20,682,580
Total	250,676,513	245,187,504	232,141,103

The decrease has been of 13,046,401 as compared with the year 1930, and of 18,535,410 as compared with the year 1929.

Property

The property is actually in first class condition, ensuring an efficient and economical operation. You no longer see old cars in Montreal, all are of modern type, and the service outside of rush hours, is give with cars that are all practically new.

Since the coming into force of the contract, tracks have been repaired or rebuilt when and as required, unused tracks have been removed, and extensions carried out. As to their present value, let me quote an extract of a report made by Mr. J. Thornton, superintendent of the line, Underground General Associated Tramways of London, England, to the directors of his company, upon a visit of all the principal cities of the North American continent in 1929; it read thus:—"With the exception of Chicago, Toronto, and Montreal, I found the street tramway track very poor." His appreciation may be severe for some cities, but we may draw the conclusion that those of Montreal must be exceptionally good.

Mention must also be made of the electrical system, which is an important item of the property. Electricity is purchased under the form of alternative current and delivered at two points, one at Hochelaga, the other at St. Henry. It is then distributed by the Tramways Co., at 13,000 volts to their substations scattered all over the city. At these substations, the alternative current is transformed into direct current at 600 volts, and transmitted by cables along the streets to supply the trolley wires. Since the contract, two substations have been remodeled, and seven new ones erected. Four of these are fully automatic, no attendant being required to run the

machines, they start or stop without any manipulation according to the load required by the cars on the streets.

The citizens of Montreal can rely on the electrical system of the tramways. It happens sometimes that there are short interruptions, but you will admit that such breaks seldom occur, and when they do, they are mostly due to accidents or causes outside of the control of the company. It may be well to add that in order to protect the population against any long stoppage of electric current received from outside sources, the Tramways Co. maintains a steam power plant at Hochelaga of 28,000 k.w. capacity, to be used in emergencies. If it had not been for this stand-by plant, the citizens of Montreal would have been in a very ackward situation on two occasions lately, when the transmission towers of the power companies were blown off by dynamiters.

Tariff

The present tariff was established by the Tramways Commission in 1921, and has not changed since, the average fare being 6.03 cents per passenger.

Let us examine the trend of street railway fares on the North American continent for the last ten years. For 189 American cities having a population of 50,000 and over, the weighted average fare in January, 1924 was 6.85 cents, it has since constantly increased to attain the figures 7.85 cents in November 1931.

The following table will show you the average fare in February, 1930 in the fourteen most important cities of North America.

Cities	Population	Average Fare
New York, N.Y.	5,970,800	5.00 cents
Chicago, Ill.	3,102,800	6.91 "
Chicago, Ill. (Elevated Rly.)		10.03 "
Philadelphia, Pa.	2,035,900	7.58 "
Montreal, Canada	1,019,035	6.04 "
Boston, Mass.)		
Cambridge and)	1,018,600	9.36 "
Somerville)		
Toronto, Canada		6.18 "
Cleveland, Ohio	984,500	7.89 "
St. Louis, Mo.	839,200	8.54 "
Baltimore, Md.	819,000	9.24 "
Minneapolis & St. Paul, Minn.	697,800	7.71 "
Pittsburgh, Pa.	665,500	8.03 "
Los Angeles, Cal.	576,673	6.43 "
Kansas City, Mo.)		
Kansas City, Kan.)	500,600	7.35 "
New Orleans, La.	424,800	7.00 "

Relation between the Tariff and the Service

There is no question so much discussed in any city, than that of public transportation, and the tariff charged for same. We must not forget that they depend one upon the other, and that a tramway company has to be administered in the same way as any other business concern. The commission is obliged under the contract to fix a tariff which shall procure sufficient revenues to meet all expenditures, and for a certain tariff and a certain number of revenue passengers, the service must be kept within a definite limit. In Montreal, the city cannot be called upon to make up for any deficit, like it is done in New York, and some other big cities, on the contrary, the system has to pay annually to the city a sum of money exceeding one million dollars for city rental, taxes and snow removal. For the

year 1930, 7.3% of the gross receipts were thus paid to the city.

The commission often finds itself in the position of not being able to accede to some requests of the citizens which would call for too great an expense, and would in the end, result in the increasing of the fare. It may be of interest to give you a few figures in connection with the cost of construction and operation of a tramway system. A double track line built in a street paved with asphalt, with poles and trolley lines costs $135,000 per mile. To supply the electric current requires the laying of the cables and the construction of converting substations. A modern automatic converting substation of 3,000 k.w. capacity, costs at least $225,000. The cost of a tramcar is about $17,000, and of a 33 passenger autobus around $12,000.

During the year 1930, the tramway service cost $4.36 per hour, (this includes fixed charges) the autobus service cost $2.88 per hour. To meet the expenditures it was necessary to collect 7.75 average fares of 6.03 cents per car-mile for the tramways, and of 4.13 average fares of 7.09 cents for the autobuses. This may seem to be a very small number when you sometimes see all cars crowded.

The following shows the density of the tramway lines operated in the city, during the year 1930, which may be divided into three groups, viz:—

21 good	density	7.8 and over
14 medium	"	5.0 to 7.8
14 bad	"	5.0 and under

The good lines must pay for the medium and bad ones.

Zone Fare and Uniform Tariff

By "Zone Fare" is meant that the price paid for transportation varies according to the distance travelled. This system is used in some European cities, but very little in America. We use here what we call the uniform tariff by which a passenger may go to any point on the System, regardless of the distance travelled, for the price of one fare,—this system was adopted for Montreal. Its advantage is that it favours the development of a city, outside of its congested district, but on the other hand, it becomes more and more difficult to provide transportation at a low fare. Instead of serving a populated district, the cars have to travel long distances to reach the outlying districts, and it is well to remember that the tariff has not changed in Montreal since 1921, contrary to what was the case in most American cities.

The service has been extended as much as the revenues permitted to do so, and the tramways authorities think that they have reasonably kept pace with the development, and to be convinced of that, one has only to look at the map showing lines spreading in all directions, to distances reaching in many cases from five to ten miles.

Autobus

As soon as the autobuses were developed to a point where economical and regular operation could be assured, the tramways authorities decided to introduce same in Montreal,—and in August 1925, the first buses were put in operation. These autobuses are used as auxiliaries to the tramways, they are mostly used as connecting lines between tramways routes, and on streets where it is not advisable to lay tracks. They are of special value in districts where the population is not large enough to jjustify the establishment of tramway lines. The concensus of opinion in America is that in a large city of a million population and over, transportation by means of autobuses will not meet the requirements unless used in conjunction with a system of transport of large capacity, such as subways, elevated lines, or surface tramways, capable of moving during rush hours, morning and evening, the large crowd of workingmen and office employees,

with the least number of vehicles as possible, specialy when surface transportation is used, so as to save the space of the street already too small for the present lay traffic.

During rush hours, a street car can load at least 2½ times the number of passengers than that of a single deck autobus,—this is the reason why they cannot take the place of the street cars on the main arteries of transport. Try to visualize what St. Catharine St., a four lane street between Bleury and Guy St., would look like especially in Winter when the roadway is often obstructed with snow, when the uninterrupted flow of street cars in both directions would be replaced by a number of autobusses 2½ times greater; add to this the mass of automobiles, and you will have no difficulty to reach the conclusion that the autobuses alone could not solve the intricate problem of traffic.

The tramways authorities consider the autobus a very efficient system of transportation when used in conjunction with its street cars, and its service is well patronized. For this reason, the number of same has increased very rapidly, and the ompany owns to date 153 autobuses,—the number to be increased as required.

Traffic in the Congested District of Montreal

The Tramways Co. is greatly interested in traffic, conditions, as they have to move through the congested streets at least 75% of the population. I have only time to say a few words on the main aspects of this very vital question.

In an address delivered before the members of the Engineering Institute of Canada, the chairman of the Tramways Commission, Judge J. F. Saint-Cyr, summarized the situation as follows:—"In all great urban centres, speed is one of the essential elements of the traffic problem. What matters is not so much the distance from one's home to one's place of business, as the time it will take to go from one's home to one's business. Indeed, if I can travel two miles in five minutes, I do not live further than five minutes' walk. As there is a limit to the time one wants to take to travel every day, morning and evening, it becomes necessary to compensate the distance by speed,—otherwise the expansion of a City is checked.

In a report on the survey of Cincinnati in 1927, John A. Beeler, President of the Beeler Institution of New York, says:—"We have come to the age of rapid transportation. Without rapid transportation no City can live. It is either that or drop behind".

Conditions in Montreal are well known to you, they are no worse than elsewhere, the same problem exists in all cities of the world. As stated in an article published by the Westinghouse Company,—"Cities have a traffic problem largely because the street-users have outgrown the street space. Roadways built in 1189 are not an inch wider to-day, and modern traffic leaves them sadly unable to carry their load. Cities grow larger, but streets only grow older." I may add that in the olden days, the streets were practically clear of traffic, whilst to-day, in most cases, the width of the roadway is reduced by one-half by parking of vehicles.

You sometimes hear that the streed cars are obstructing the roadway occupied, and the number of people transported during rush hours. Let us examine together the relative efficiency of both as regard to the space of roadway.

Numerous traffic counts made in several Cities including Montreal, show that the average number of passengers carried by automobile is not more than 1.8, and require about 80 square feet of roadway, that is 45 square feet for each passenger. A street car covers 375 square feet, and the number of passengers carried at rush hours

is at least 75, thus requiring 5 square feet per passenger, forty-five square feet against five, an efficiency 9 times better for the street cars. In other words, as these vehicles are used to-day, one traffic lane of street cars carries as many people as 9 lanes of automobiles.

Mr. R. N. Watt, assistant to the President of the Montreal Tramways Co., in an address delivered lately before the Junior Board of Trade of Montreal, explained with figures that the space covered by the street cars in Montreal is less than 5% of the total area of the public roadway, and yet the street car passenger in addition to paying the regular taxes of the city, pays a special additional tax through his fare, and he adds—"Surely the tramways passenger, representing 80% of the people, paying additional taxes through his fare, practising the greatest economy in street space, is justified in occupying 5% of the street space of the city."

I wish you to understand that I am not criticising the use of the automobile, it is a modern and convenient system of transport which has come to stay. I want only to emphasize its limitation with regard to public transportation in the congested districts of large cities like Montreal where there are no subways or elevated lines to carry the bulk of the population. It is also given as an explanation to those who would be inclined to think that our street cars are obstructing the traffic. As stated by Judge Saint-Cyr chairman of the Tramways Commission in an address before the Chambre de Commerce of Montreal in May 1929—"When we insist upon the right-of-way for the tramways, we are simply considering the interest of the immense majority of the people".

I now wish to show you a few slides which will enable you to make a comparison of the number of automobiles and trucks in our city, with that of other cities on the American continent.

Motor Vehicle Registrations in selected cities for the Year 1930.

City	Population	Automobiles	Persons per vehicle
Kansas City	400,499	89,600	4.5
Washington	552,000	151,450	3.6
Baltimore	836,000	144,947	5.7
Boston	809,679	145,000	5.5
Buffalo	575,000	156,688	3.6
San Francisco	766,008	154,113	4.9
St. Louis	848,100	190,817	4.4
Montreal) Westmount) Outremont) Verdun)	1,206,000	73,107	16.5

Motor Vehicle Registration in Canada for Year 1929

Provinces	Estimated Population for 1929	Automobiles	Persons per vehicle
Prince Edward Island	86,100	6,141	14.0
Nova Scotia	550,400	40,014	13.7
New Brunswick	419,300	31,852	13.2
Quebec	2,690,400	169,547	15.9
Ontario	3,271,300	542,771	6.0
Manitoba	663,200	77,840	8.5
Saskatchewan	866,700	130,229	6.6
Alberta	646,000	99,650	6.5
British Columbia	591,000	95,647	6.2
Yukon	3,000	198	15.2
Territories	9,400		
Canada	9,796,800	1,193,889	8.2

It is seen by the above that the number of automobiles and trucks in Montreal per capita, is much less than that of other cities of similar population, and I think we are justified to expect a considerable increase during the next ten years.

At the present time, I think you will agree with those who have travelled, and who have had the opportunity of making comparisons with other cities using surface tramways and autobuses, that Montreal has a system of transportation inferior to none. However, if Montreal is going to continue to grow, and if the automobile and truck traffic is to increase as expected, the question of transportation in the centre part of the city will become very accute.

The problem may be solved in different ways, whether by providing additional streets or widening existing ones, with provisions for grade separation at many points, which will require tremendous outlay of capital expenditures, or by the building of subways or elevated lines, where mass transportation can be carried out, releasing the street for the balance of the traffic, a thing which will also be very costly. The method to be adopted should be one which will give the best results for the amount of capital invested,—due consideration to the interest of citizens at large.

Let me quote, to this effect, an extract of a report made by a Committee of the American Electric Railway Association on the Movement of the Vehicle,—"The objective should be to co-ordinate the construction and operation of the principal agencies of urban passenger transportation, and means for their use, in such a way as to provide a maxium of public benefit. If this is sound, then it would seem unwise to permit one facility to interfere out of proportion to its public usefulness with the operation of another, nor should public funds be devoted to the benefit of one type of transportation service to the exclusion of another presently more used and useful in the public sevice.

It was stated in the annual report of the Tramways Commission for the year 1930, that,—"the time was rapidly approaching when surface transportation alone could hardly be depended upon, and more rapid means of transportation will bocome a necessity." The Montreal Tramways Company has put before the public for their consideration a proposal for the building of subways. The present business depression has momentarily stoped all activities in this direction, nevertheless, the citizens would do well to now study these plans in order to be well informed when the necessity of reconsidering this question arises.

There is one thing, however, which we can do now, and that is to use to best advantage what we have. The real difficulty of rapid transportation occurs during rush hours, morning and evening, when the population is in a hurry to get to work or anxious to get home as quickly as possible. Therefore, let us clear the congested streets during rush hours in order that traffic can move rapidly. I wish to reiterate the request often made by the tramways authorities to abolish in the congested district during rush hours, on streets where tramways are operated, parking of vehicles of all kinds, delivery trucks and rigs included. Most of our main arteries allow only for two lanes of traffic in each direction, we will then have one lane for mass transportation, and one for the balance of the traffic. A strict enforcement of such regulation shall be required to be of any value, because a few vehicles parked here and there along the curb are sufficient to close half of the street. No doubt you have often witnessed, between 5 and 6 o'clock in the evening, parked cars in violation of a By-law, often right under a no-parking sign or sometimes worse, near the corner of a busy intersection. Is it reasonable that the great bulk

Amounts Paid to the City of Montreal from 1918 to 1930 — Table No. 5

Period	Snow Removal	Taxes, Permits, etc.	Rental	Share of Surplus	Total
1918-19 (a)	$182,865.67	$194,678.00	.....	.....	$ 377,543.67
1919-20 (b)	145,000.00	241,332.26	.....	.....	386,332.26
1920-21	92,688.34	237,319.13	$232,076.15	.....	562,083.62
1921-22	103,155.05	250,471.13	639,133.07	.....	992,759.25
1922-23	190,800.85	255,812.28	889,151.65	.....	1,335,764.78
1923-24	336,761.43	302,618.47	1,048,695.19	.....	1,688,075.09
1924-25	209,328.62	278,318.27	883,637.99	.....	1,371,284.88
6 mos. 1925 (c)	.....	305,977.81	250,000.00	.....	555,977.81
1926	252,746.23	322,897.92	500,000.00	.....	1.075,644.15
1927	250,505.03	336,487.62	500,000.00	$186,361.92	1,273,354.57
1928	243,335.67	367,892.63	500,000.00	.....	1,111,228.30
1929	261,398.58	352,116.97	500,000.00	38,495.01	1,152,010.56
1930	171,181.36	426,998.70	500,000.00	21,783.48	1,119,963.54
Total	$2,439,766.83	$3,872,921.19	$6,442,694.05	$246,640.41	$13,002,022.48

(a) From February 10th, 1918, to June 30th, 1919. (b) Until June 30th, 1925, the fiscal year starts on July 1st. (c) From July 1st to December 31st.

Car-Miles and Passengers Statistics since February 10th, 1918 — Table No. 6

Period	Tramways Car-miles	Tramways (A) Passengers	Autobuses (d) Bus-miles	Autobuses (d) Passengers	Total Miles	Total Passengers	(A) Transfer (Tramway Passengers)	(A) % Transfers
1918-19 (a)	32,090,612	254,139,121	.....	.....	32,090,612	254,139,121	91,214,080	35.89
1919-20 (b)	22,888,670	191,941,835	.....	.....	22,888,670	191,941,835	63,744,151	33.21
1920-21	21,803,871	190,212,799	.....	.....	21,803,871	190,212,799	69,335,426	36.45
1921-22	21,547,345	188,201,367	.....	.....	21,547,345	188,201,367	73,851,859	39.24
1922-23	22,318,701	193,519,038	.....	.....	22,318,701	193,519,038	79,123,158	40.89
1923-24	23,306,067	200,035,062	.....	.....	23,306,067	200,035,062	84,785,435	42.39
1924-25 (b)	23,348,171	200,338,484	.....	1,026,630	12,108,365	101,760,290	44,751,520	44.43
6 mos. 1925 (c)	11,820,671	100,733,660	287,694	.....	23,348.171	200,338,484	87,874,165	43.86
1926	24,934,224	207,754,983	1,543,632	5,370,475	26,477,856	213,125,458	92,440,444	44.49
1927	26,101,169	211,789,557	2,868,886	10,728,326	28,970,055	222,517,883	95,137,843	44.92
1928	28,104,171	223,355,996	3,716,843	14,150,625	31,821,014	237,506,621	101,405,910	45.40
1929	29,628,936	234,251,565	4,163,085	16,424,948	33,792,021	250,676,513	106,115,038	45.30
1930	29,305,545	227,136,581	4,559,274	18,050,923	33,864,819	245,187,504	103,456,331	45.55

(a) From February 10th, 1918, to June 30th, 1919. (b) Until June 30th, 1925, the fiscal year starts on July 1st. (c) From July 1st to December 31st. (d) The autobus service was inaugurated on August 6th, 1925.

(Tramways) Digest of Operations of the Montreal Tramways Company from 1918 to 1930 — Table No. 7

Period	Operating Receipts	Operating Expenses	Receipts	Charges	*Deficit
1918-19 (a)	$11,572,210.48	$8,784,763.85	$2,787,446.63	$4,151,558.37	*$1,364,111.74
1919-20 (b)	10,782,470.09	8,087,076.00	2,695,394.09	3,060,094.29	* 364,700.20
1920-21	11,773,004.87	8,904,337.72	2,868,667.15	3,107,689.65	* 239,022.50
1921-22	11,712,525.11	8,396,563.31	3,315,961.80	3,128,014.29	187,947.51

(Tramways) Digest of Operations of the Montreal Tramways Company from 1918 to 1930 Table No. 7

Period	Operating Receipts	Operating Expenses	Receipts	Charges	*Deficit
1918-19 (a)	$11,572,210.48	$8,784,763.85	$2,787,446.63	$4,151,558.37	*$1,364,111.74
1919-20 (b)	10,782,470.09	8,087,076.00	2,695,394.09	3,060,094.29	* 364,700.20
1920-21	11,773,004.87	8,904,337.72	2,868,667.15	3,107,689.65	* 239,022.50
1921-22	11,712,525.11	8,396,563.31	3,315,961.80	3,128,014.29	187,947.51
1922-23	12,056,355.06	8,641,090.39	3,415,264.67	3,067,710.92	347,553.75
1923-24	12,463,798.76	8,875,224.44	3,588,574.32	3,039,879.13	548,695.19
1924-25	12,476,566.76	8,950,945.24	3,525,621.52	3,141,983.53	383,637.99
6 mos. 1925 (c)	6,305,491.88	4,678,590.93	1,626,900.95	1,626,900.95	.....
1926	12,899,602.31	9,508,480.28	3,391,122.03	3,322,860.97	68,261.06
1927	13,106,947.20	9,296,067.03	3,810,880.17	3,379,141.23	431,738.94
1927 (d)	621,206.39	.....	621,206.39	.....	621,206.39
1928	13,891,202.25	10,455,838.43	3,435,363.82	3,435,363.82	.....
1929	14,421,539.15	10,721,092.52	3,700,446.63	3,572,129.93	128,316.70
1930 (e)	14,016,665.84	10,196,575.47	3,820,090.37	3,747,478.77	72,611.60
Total	$158,099,586.15	$115,496,645.61	$42,602,940.54	$41,780,805.85	$(f)822,134.69

(a)—From February 10th, 1918, to June 30th, 1919.
(b)—From July 1st to June 30th, until 1925.
(c)—From July 1st to December 31st.
(d)—Proceeds from the settlement of "Unredeemed Tickets."

(e)—Total Gross Receipts $15,352,510.53
Less " " (Autobuses) .. 1,279,864.92
$14,072,645.61
Less Deficit (Autobuses) 55,979.77
$14,016,665.84

(f)—The surpluses have been distributed, according to the contract.

Autobuses
From August 6th, 1925, to December 31st, 1930 Table No. 8

Period	Gross Receipts	Operating, Maintenance and Renewal Expenses	Operating Ratio	Fixed Charges	% on Receipts	Surplus or *Deficit
August 6th to December 31st, 1925	$ 73,062.06	$ 68,114,75	93.23	$ 5,446.27	7.45	*$ 498.96
1926	414,049.23	372,339.32	89.93	32,916.25	7.95	8,793.66
1927	787,200.46	705,318.60	89.60	61,044.44	7.75	20,837.42
1928	1,025,604.51	964,828.11	94.07	82,647.80	8.06	* 21,871.40
1929	1,178,973.86	1,153,720.59	97.86	94,652.16	8.04	* 69,398.89
1930	1,279,864.92	1,231,139.88	96.19	104,704.81	8.81	* 55,979.77
Total and %	$4,758,755.04	$4,495,461.25	94.47	$381,411.73	8.01	*$118,117.94

of the population should suffer for the egotism of these few? The police cannot be everywhere at the same time, and we have to rely upon the good will of all citizens for proper observation of traffic regulations.

We must bear in mind that Montreal is now one of the great cities of the continent,—indeed of the world. Our country is young, and it is reasonable to expect a rapid growth of our cities. One of our most imperative duties, will be to see that our System of mass transportation is enlarged and developed on the right lines, to meet the future needs of the population. Numerous difficult problems will surely arise, and to solve them properly, the cooperation of all citizens will be required.

Planning and Building of a Modern Factory

BY W. BRUCE RIDDELL, A.R.I.B.A.
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(Before Hamilton Chapter, March 3, 1932)

THE pleasant task which has been assigned me tonight is one which involves the study of industrial development over a period of some two or three decades and in tracing this development we find it influencing our modern civilization to such an extent that we ourselves no longer live in an aesthetic age but rather in a material age surrounded by an atmosphere of expansion in commerce and industry. It is this highly developed element in our present day civilization with all its many ramifications that produces what is known as modernism.

No one will contest that statement that since the advent of the 20th century the advancement of science in all its branches has gradually forced upon mankind a worship of that materialism which in turn has developed our culture to a point where we are no longer satisfied to live in surroundings of simple comforts but rather to long, to strive, and to struggle for the elements of luxury and extravagance. Is it not true that our necessities are too luxurious and our luxuries too necessary.

It is in the development and growth to this worship of the god of materialism that modern industry is what it is today; and modern industry in itself is progressing from a "simple past" to an "involved present" and on into a "highly complicated structure of the future."

The subject of this address tonight "The Planning and Building of a Modern Factory" has nothing whatever to do with the "simple past" or the "highly complicated future," but it does have a bearing upon the "involved present" of industrial planning and building.

In order that my subject may have some elemnt of continuity and that its evolution may be complete I have arranged it under group headings which cover, I think you will agree, the salient points in the development of a modern industrial plant. It is impossible however in the short time allotted for this paper to cover all of the various details that occur in the construction of a modern "palace of industry" but I will endeavor to give you a suggestion of the many problems which must be faced in a work of this character.

1. The Desire to Build, Enlarge or Replace.

We may, I think, pass quickly over this consideration with but a few observations:

(a) A new plant is to be built: It is quite obvious why. To house either an entirely new industry or to establish a branch of an existing plant.

(b) An existing plant is to be enlarged: Undoubtedly the reason for this is to provide for the economic and efficient manufacture of the products of the company where the market demand has exceeded the output of the existing plant and where business has so increased that plant expansion is expedient.

(c) An existing plant is to be replaced: Here is where we find ourselves facing the "involved present" of modern industry, for the old "Soap Works" or the antiquated "Carpet Factory" are no longer capable of competing either economically or efficiently with the modern plant of its competitors and the demand is now for speed, for quantity not quality, for quicker distribution, for better labor conditions and for a host of other demands which are constantly assailing the industrialists and the manufacturers of the present day. And at this point let me interject a typical instance of the obsolete versus the modern plant and in so doing give you an explanation of the phrase "involved present" of modern industry:

A newsprint corporation in the early years of the present century were faced only with the problem of presenting to the public the news of the time. Such news many be a day late, it may be a week late but nevertheless it was news and the public were satisfied. If the papers were on the streets before evening no complaints were heard, the demands of advertisers were negligible and the papers consisted of not more than 12 or 16 pages. Surely the publishers lived in an atmosphere of quiet tranquility. Compare the publishing business of 1901 with the business of today and what do we find. Speed and a complicated service are the modern demands. News is not news if it is 12 hours late, indeed it is not news if it is 2 hours late, for when we leave the football or the baseball game we are greatly disappointed if by the time we reach down town the papers are not on the streets giving play by play, word by word the story of the contest; the reports of a war in China must be hot off the wire or they are uninteresting; the demands of advertisers are enormous and the quantity of reading matter, good, bad or indifferent, has so increased that papers today consist of seldom less than 24 pages and often reach 60. The old plant with its equipment would in the light of the demands of the present day be not only antiquated but entire obsolete, unfit completely for the work it is expected to produce. And then we ask what is meant by this "involved present" of modern industry. Whether that industry is of the nature of publishing, or communication, or distribution, or soap manufacture it is highly complicated and the old must make way for the new, the antiquated carpet factory must be scrapped and a modern and efficient plant erected in its place, a plant which will produce on a profitable basis.

The desire to build, enlarge or replace having been decided it must necessarily follow that the next consideration is the selection of site, and this I have placed under heading number two.

2. Selection of Site.

While this has very little bearing on the planning or building of a modern factory I would like before passing to indicate to you several points which will undoubtedly affect this decision. Certainly

the first consideration will be the problem of transportation either by rail, water, or transport, depending entirely upon the nature and scope of the industry. The problem of centralized distribution will also have a bearing upon the location. The difficulty or ease of securing sufficient trained labor and skilled mechanics and the problem of housing these employees must also be faced in selecting a site. Probably, however, in the light of modern day policy one of the most important considerations is that of advertising. This I will cover later in my address, suffice it to say at present that the advantages and benefits derived from a prominent location where the industry will be continually before the eyes of the public are very great.

3. Financing.

Under the heading of financing I have no intention of going into this in detail other than to point out two or three methods whereby building is financed. Probably the most desirable but undoubtedly the most unlikely means of financing is by direct cash on hand. Such a building might also be financed by a proportion of cash, and balance on mortgage, the difficulty in this case being the securing of a mortgage, as the lenders of money are not particularly attracted to industrial development. The two most common means of paying for work of this nature are undoubtedly the flotation of a bond issue or the increasing of capital by the selling of stock.

So much then for the financing.

4. Selecting the Architect.

The next important detail in the development of a project of this kind is the securing of a properly trained and qualified architect and with the architect, his associate engineers for the structural and mechanical trades. Too much stress cannot be laid upon the necessity and desirability of retaining a professional adviser as it will save the owner an enormous amount of unnecessary worry and responsibility, will assure him of a building soundly built, economically planned and in actual dollars and cents save the architect's commission many times over by having a building properly planned and constructed on a basis of profitable production.

The enormous amount of work and details which the architect is called upon to do is outlined in the details of the building which will follow:

5. Factory Planning and Process Layout.

Under this heading you will readily see that the details of plan and layout will vary considerably depending entirely upon the class of manufacture. In this study one must take into account the sequence of operation, taking the material from its raw state and carrying it through the various departments to a finished product. Where the industry is carried out on a large scale the factory plan and process layout will necessarily have to be arranged for a systematic operation for mass production. The proper location of receiving and shipping facilities together with stock and store rooms must receive careful consideration and in some types of industry the proper provision for bonded warehousing must be made.

With due consideration having been given the foregoing details it brings us to the point of selecting the type of building and this I have considered as the next heading.

6. The Type of Building.

Here again the character of manufacture will to a great extent determine the type of building.

One must consider whether or not it will be desirable and economical to have the manufacturing areas located all on the one floor and

if this is not expedient the building will undoubtedly resolve itself into a series of stories. The location of stock rooms for raw and completed material must be thoughtfully considered and last but not least the necessary office requirements with their varying accommodations must be well planned and designed. Following directly out of the decision as to the type of building will come the type of general construction and this is in a measure described in the remarks which follow.

7. Type of General Construction.

A decision in this regard involves alternatives. Shall the building be non-fireproof, semi-fireproof or shall it be so called fireproof. The non-fireproof building is constructed of load bearing brick walls and wood joists, structural steel or wood beams and columns, wood floors and roof. The initial cost of this type of construction is unquestionably cheaper than any other but it does not follow that it is the most desirable. In a semi-fireproof type of building we have what is known as mill construction, similar in some respects to the non-fireproof type, but varying usually in the detail of floor and roof construction. Of the fireproof type we may use either the skeleton steel or the skeleton reinforced concrete principles of construction, although under certain fire conditions even these types are not entirely fireproof.

The fundamental of skeleton steel construction constitute structural steel columns, girders, beams, and joists with concrete floors; the steel frame work on the outside being merely encased with non-bearing brick curtain walls.

The fundamentals of skeleton steel construction constitute structwo types, namely: (a) The girder, beam, column and slab construction with tile or tin pan floor slab, and (b) The flat slab of mushroom construction which consists of columns with head pad only and is free of all interior girders and beams. The economy in either of the two types of fireproof buildings lies in the saving in insurance rates, plant upkeep, and depreciation. Where the entire plant is located on one floor sound arguments may be used for the selection of non or semi-fireproof construction but where the building develops itself into a series of stories the fireproof construction is unquestionably the proper type.

8. Details of Construction and Plan.

The architect and owner having determined upon the character of the building and the type of general construction the next step involves the consideration of numerous smaller details which are so vital to the economic and efficient success of the building. Again these details will vary with the type of manufacture but in a general summary they may be enumerated as follows:

(a) Machinery foundations.
(b) The determining of floor loads both dead and alive.
(c) The proper treatment of walls against dampness by use of either membrane, integral or surface waterproofing.
(d) The protection of steel from corrosion and fire.
(e) The hardening and treatment of concrete floors.
(f) The problem of designing the plant with a view to providing a full and generous measure of daylight. This is accomplished through the medium of factory sash, skylights, monitors, lanterns, saw tooths, etc.
(g) Horizontal and vertical circulations which develop the proper location of stair towers, elevators, travelling cranes, hoisting and carrying apparatus.

(h) Proper accommodation for employees both male and female such as locker rooms, lunch rooms, toilets, first aid and emergency rooms.

9. The Work of Mechanical Trades

The Architect having determined upon the general plan, construction, design, and the exterior treatment of the building, the next step is the laying out of the work of the mechanical trades. The work of these trades consists as follows:

(a) **Plumbing:**
The plumbing deals with toilet and wash room facilities, rain water disposal, sewers, drinking fountains, and in many cases plant process requirements.

(b) **Heating:**
The heating of the plant may be handled by various methods, usually from a steam generating plant with the heat distributed through the building by either direct radiation, indirect radiation, or unit heaters, and the principle of distributing this steam to the heating units either by means of gravity, low pressure, vacuum, or pressure circulating principles.

(c) **Ventilation:**
The element of ventilation in any industrial plant is of vital consideration and may be accomplished either by natural or forced draft. Ventilation is essential for the purpose of eliminating odors, gasses, excess moisture, and for the comfort and efficiency of employees.

(d) **Wiring:**
The wiring problems connected with any industrial building are numerous and constitute the necessary requirements both for lighting and for power. The lighting arrangement is of vital importance and the design of this detail requires careful thought with a view to making sure all sections of the building are properly luminated. The wiring for power will of course, as you can readily see, vary extensively depending upon the character of the plant and its product.

(e) **Sprinklers:**
Another very important branch of the mechanical trades is the layout of sprinkler systems for fire protection and involves a careful study of the complete floor area with a view to making sure every section is amply covered by the sprinkler heads which automatically break when brought in contact with a relatively low temperature.

This outline does not by any means cover thoroughly the work of the Mechanical trades but it does give you a suggestion of the vast amount of detail which must be planned and designed in order that the plant may be successfully completed.

10. Specialized Features In All Industrial Work

The planning and designing of all industrial work involves to a very marked degree specialized details which of course are exceptional to each individual job. It might be well for me to touch upon a few of these in order that you may grasp the special problems peculiar to factory work:

Humidification:
One of the most important is the problem of humidification and this is, you may be sure, an intricate study in

itself for the principles involved under varying circumstances are so complicated that in the scope of this talk it would be folly for me to even attempt a description of these principles.

High Pressure Steam Process Work:

Here again we have a problem which is peculiar to certain classes of industrial buildings and consists of delivering to certain portions of the plant high pressure live steam for process work. This instalation is usually called for in packing and canning plants, dairies, bottling works, tailoring plants, cleaning and pressing establishments and in industrial buildings which include dye houses, shrinking rooms, etc. The bringing of this high pressure live steam to these various points throughout the building involves special principles and careful construction which would include pressure reducing valves, traps, expansion joints nd other specialties.

Vacuum Process Work:

This is a problem which will face the Architect in various types of manufacturing buildings and it has always been a vital problem as to the most satisfactory way of handling this requirement. We particularly run across it in tailoring plants and cleaning and pressing establishments where it is necessary to draw quickly away from the large pressing tables the surplus steam and moisture which has been deposited in the process of manufacture. This problem is also present in certain types of manufacturing buildings where the elimination of other wastes from process is vital. I refer particularly to cotton and wollen mills and plants specializing in the products from wood such as furniture factories, lumber mills, etc.

Intercommunication:

In all industrial work it is vital to have the entire plant properly controlled by means of inter-department communication. This problem is usually handled by means of bells. gongs or telephones which are controlled from the main switch board. Coupled with this problem of intercommunication is also the problem of a protecton signal system for the watchman. This will consist of certain definite stations established throughout the plant where the watchman turns in at certain appointed times a signal that he has been over that section of the plant and has found everything in order. There are other special features but I will not take up your time now in enlarging upon them.

Were I to complete this paper without leaving with you some thought as to the Architectural treatment of industrial buildings I would feel that my egort in this connection was entirely futile. It is quite true that in the past manufacturers and industrialists were quite satisfied so long as their plant had four walls and a roof, so long as it had utility, and the thought of creating a beautiful factory was entirely remote from them. In the past decade, however, an entirely new school of thought has come into being and we find today that the builders of factories, that boards of directors, presidents and owners, have come to the realiration that it is very little if any more expensive to erect a plant which has in some measure

the ear marks of Architectural design and they also realize that an attractive building is money well spent for it creates in the mind of the transient public a favorable impression which they carry with them. An attractive building is in most cases cheap advertising and in very large community today we find the new industries setting a standard in Architectural design which is indeed admirable. The old ugly buildings of the past are rapidly falling into the discard and cities today are being beautified not alone by their public edifices, or by their churches, or by their homes, but indeed to a great measure by their industrial buildings, buildings which add to the contentment and to the pride of the employees and add a touch of dignity to the entire community and its surroundings.

Group Incentives

BY R. PRESGRAVE

York Knitting Mills, Ltd., Toronto

(Before Central Ontario Chapter, December 10, 1931)

I WAS asked to speak on wage incentive systems, but I am narrowing the field somewhat, realizing that to treat the subject generally would be a vain repetition of boring data found in every text on factory management and heard almost inevitably as the opening portion of any address on labour control. In the hope of avoiding this I want to deal to-night with one specific phase of wage systems that has recently come into marked prominence.

I woul like in passing, however, to point out that the numerous schemes ascribed to Taylor, Halsey, Rowan, Gantt and others are used in practice in inverse proportion to the frequency of their appearance in the books and magazines. They have become the foundation stones upon which more modern and, it is thought, more effective plans are built. This by no means lessens their fundamental importance, but it does exclude them as subjects upon which the average business man requires specific information.

Group payment plans are among the latest additions to the superstructure and their protagonists claim much for them, many of them going so far as to believe that there is no other or better scheme. With this I heartily disagree. I do feel however, that the group plans have a definite place and I am strongly in favour of using them in preference to day work in circumstances which make the individual incentive inapplicable. Morever there is no doubt that such plans have received set-backs at times because their enthusiastic supporters have put them in the wrong setting.

Main Principles

No doubt you are all at least partly familiar with group plans, but in case there is any doubt and for the sake of making sure that we all have the same picture in mind, I shall briefly outline the methods and ostensible purposes of the plans.

The germ of the scheme lies in no altruistic communistic idea, but really originatel in the familiar contract labour plan in which a job is let out to one man, leaving him to hire his own help at such wage as he can, the difference between these wages and the contract price going to himself. This method is obviously so open for abuse that it is not

considered at all except a little enviously by some manufacturers who see in it an easy way of knowing and controlling costs.

The proper development to eliminate abuse is the present method in which the manufacturer still retains all control of the wages paid. The workers are divided into logical groups of varying sizes, each group carrying a working supervisor and probably a certain amount of Indirect help. The group now assumes a corporate identity and is treated much the same as if it were a single person.

Instead of every operation carrying a separate piece-rate, the rate is placed upon such articles as is completed by the group as a whole. The sum earned by the group is distributed in some presumably equitable manner among the members, usually directly in proportion to the hours spent and weighted by the relative importance, difficulty and so on of the individual's job. Since it is obvious that the earnings of the individual are modified by the efforts of the group, the incentive is not very apparent. However, it does exist and in many cases operates quite strongly.

Arguments For Group Incentives

The claims put forward in favour of the scheme are many, and in most cases perfectly valid. You will find them fairly fully set forth in "Cost and Management" for October, 1931. I should like to review some of them.

The main claim is for increased productivity and decreased cost. This is quite true, but it is not a unique feature and by no means disposes of the question as to whether or not the individual incentive plans may not permit of equal or even greater savings.

Another claim is made for increased esprit-de-corps and co-operation. There is little doubt that a properly functioning group is usually clear proof enough of this benefit. If the proper spirit can be aroused, the group will function very satisfactorily as to volume, quality and control with virtually no outside supervision. In this respect it seems to be the current experience (it certainly is mine) that groups for men are, in the main, more successful than groups for women. The reasons are psychological and it is not necessary to go into them here. Admitting the value of the plan in the above respect it is only fair to point out that morale and esprit-de-corps are as much a matter of external conditions as they are of internal agreement.

A third supposed advantage is that of the maintenance or even improvement, of quality. This, I believe to be quite irrelevant. In the last analysis, quality is almost invariably a reflection of the attitude and policy of management. Moreover, I feel safe in saying that any prescribed standard of quality may be attained and held under any reasonable wage payment plan from day work up.

A most agreeable point in favour of the group plan is the substantial reduction in records and in clerical work, as well as in cost computations Where in piece work, twenty men might cash in on twenty or more coupons, under the group plan the entire twenty would cash in on one coupon. This is not a clean cut saving as we still have the pro rata distribution to compute, but there is no gainsaying the fact of a saving and a worthwhile simplification.

Again it is thought that under the group plan new employees are trained more quickly. Other things being equal this is a fair contention. Rapid training is automatic within the group while in the individual incentive plan considerable external control is required.

Many other claims are made, but for the most part it will be found that these hold good for any fair incentive plan as compared with day work.

Weaknesses

Against the several advantages the unbiased observer can hardly fail to notice one or two drawbacks which verge on the fundamental. The main weakness, to my mind, is the fact that by its very nature it presupposes that each man in the group will put forth the same effort and have the same productivity as the others. I wish to make myself clear on this point. I do not mean that all persons in the group will earn the same sum, for naturally those on work requiring more skill will receive higher base rates. I do mean, however, that if there are ten persons within the group doing identical work, then each will receive the same pay as the other nine for the same period of time.

That ten men each doing his best and unhampered by external restrictions will each produce the same amount of work in the same time is a ridiculous assumption. Variations within normal limits are often in the ratio of 2 to 3. i.e. one man may be able to do 50 percent more than another when each is doing his utmost.

No matter what claims are made to the contrary, the group system, at least by implication, denies this proven fact and thereby proves itself to reward inequitably. Any attempt to overcome this difficulty results in a return to the individual incentive.

The Individual Incentive

This brings us to a philosophic question. Admitting that the group plan does not reward in direct proportion to the effort expended, what of it? The answer will, of course, depend upon whether you are inclined socialistically or individualistically. Personally, I feel that every person should have the inalienable right to shine if he can and to cash in on his shininy. I am quite prepared to admit that this is a reactionary idea and that the "one-for-all' and "all-for-one" basis of the group plan shows a more advanced social development. At the same time, I can hardly feel that the time is yet ripe for the application of the plan universally. Moreover, I believe that the group plan has an inevitable trend towards a dead level of mediocrity of performance.

I can hardly explain this last statement better by illustration. Let us take our 10 men again and suppose that one of them is 30 percent faster than the average of the others, and this is no impossible, or even unusual thing.

By the individual incentive plan this man will earn 30 percent more than the others. By the group plan himself and each of the nine others will receive 3 percent more than the average because of his effort. Would anybody here be content to work under such an arrangement? Again, do not lose sight of the few who are below average and are rewarded beyond their worth.

I have met people who have applied the group plan throughout and they have told me that this was the cause of their gradually losing their crack operators upon whom they had more or less depended for rush work and as examples and pacemakers. Now this difficulty arises from using a group incentive when the situation calls for an individual incentive. It would be unlikely to occur if we had no choice other than that between group incentive and day work. Although we have applied the group system in several places we have not encountered this trouble because we have never used groups where individual incentives were practicable.

Which reminds me of another point in favour of the group plan, at least from the stand-point of cost. It can be put into force much more rapidly than other plans. Painstaking time studies are not es-

sential and fairly gratifying results may be had with data that would, under the individual plan, be considered most unreliable and inadequate.

From the engineers' stand-point this is very pleasant. He can use averages of doubtful validity. He can use his opinion quite freely and he may even make minor errors that will remain for ever undetected. In setting up a department on the individual plan he dare do none of these things, since any but the smallest discrepancies lose no time in coming to light. I would say that what the customer gains in cost of installation is more than offset by the failure to make the full potential savings.

I have mentioned once or twice that the failure of group plans often lies in their being applied to conditions to which they are not adapted. An analysis will show that there are several basic types of groups, varying considerably as to the degree and kind of the inter-relationships of their respective members. I am naturally interested more especially in the textile industry and intend to use it as an example. I have found that in it there appear to be four reasonably distinct phases, each one of which would react somewhat differently to the group system.

Illustrations from Textile Industry

In considering these four types we shall take them in the approximate order of their adaptability to the plan. It is very plain that the system can hardly fail of success if the group in question comprises several operations, each more or less distinct in itself, but, at the same time, inter-dependent with the rest. In the machinery manufactures a large assembly job is typical of the situation. Here it is almost impossible to record each man's output, but the product of the group is a definite unit. A textile counterpart is the mule-spinning of the worsted yarns by the French process. Here we have a team all ready to hand. The spinner is the team-leader, supporting him are two or three pieces (one of the understudy to the spinner) and a creel boy. The peculiar physical nature of the job forces these men to work as a team. While each has his own territory and his own specific jobs, none of the rest can function unless he does his proper share. Upon occasion they all join at the same job, as doffing for instance. The first piecer must tend the headstock if the spinner is busy, the second piecer must help the creeler if the bobbins run out ahead of him and so on. There is practically no way of paying each man in proportion to his effort, so if we want to provide an incentive and avoid the deadening effect of day work, we must enjoy some form of group system by paying a gross rate to the team as a whole and distributing it on some pre-arranged and reasonably equitable basis among the members.

In this instance there is virtually nothing to be said against group payment and we pass on to the second class of work and one in which the plan may hope for excellent results. One can find no better example than that presented by a room of circular knitting machines. Here is no natural team. Each operator has his own battery of machines and is not in the least affected by how his neighbour chooses to run his battery. The opportunity for team work lies in this frequently occurring situation: Operator A may have all his machines running and himself enjoying a few idle minutes, while his neighbor B has a third of his machines stopped. It would be a simple matter for A to help B to get under way, but usually he does not do this unless they happen to be particularly good friends. Under day work they may or may not help each other, but neither will care one way or the

other. Under piece work it is morally certain that neither will do anything but attend fiercely to his own knitting. It is well known that actual knitting production fall considerably below theoretical by reason of numerous stoppages, and it is also obvious that a pooling of effort on the part of the operators could do much in filling in the valleys without sensibly levelling the peaks. A group plan of some sort could do much to foster this state of affairs once the operators were brought to realize that co-operation would tend to increase the pay of all and reduce that of none. The slower operator here would not be such a drag on the team as the machines themselves more or less set the pace.

Preceding knitting comes the operation of winding, analagous to knitting to the extent that each operator has a group of spindles to run co-incidentally with other operators on similar layouts. Here the analagy ceases for, providing each girl has as many spindles as she can tend, there are no idle moments to be used in assisting another who happens to have excessive breakdowns. Each is entirely self-contained. If one is absent this has no retarding effect upon the output of the rest, but, if anything, the reverse. Here then there appears to be little or no reason for initiating a team system, and the writer, for one, feels that this field is more ideally adapted for the straight individual incentive plan than for anything else, and that the stimulus of competition and the desire to earn as much as possible will take care of the production better and with less trouble than would the co-operative principle. As pointed out before, the group has the tendency of obscuring the glow of the person who wants to and can shine. The opportunity to demonstrate, and be rewarded for superior skill or speed is to be regarded as one of the rights of the individual and is not to be ignored without good reason

There is a fourth type of group that is similar to the last mentioned but it has one outstanding difference in that the operations are performed consecutively. A group of sewing machine operators is typical. As in winding there is practically no opportunity for one operator to have incidental idle time during which she can help another. Each girl is a distinct unit, yet her work does have some bearing on the work of the others. For instance, if she is absent or incompetent she may cause delays that will prevent subsequent operators from attaining their maximum output. This commonly observed situation of the bottle-neck could be alleviated in part by team-work, where the operators, working co-operatively would learn each other's jobs and be able to fill in as circumstances dictated. At the same time, intelligent supervision can handle the situation quite as well, so that, while this class of work does offer some chance for the group, in the main it can be classed with example number three and left to the individual incentive plan.

These four instances cover the field fairly completely and are tolerably well defined. Other operations may not be so definite. For instance ring-spinning, or loom-weaving would partake of the qualities of examples two and three, while French drawing would tend to blend one and two. Cutting rooms, with divisional labour, might combine one and four and so on. In any event enough has been suggested to lead one to thoroughly analyze a situation beore attempting to install a group system.

THE COST OF FARM PRODUCTS

The Department of Agriculture, Quebec Province, is engaged on an extensive survey of the cost of producing certain important farm products from year to year in various sections of the Province. Some of the basic statistics, and the results attained thus far, are given below, through the courtesy of Raoul Lecuyer, of the Department.

Survey No. 1

COST OF MILK PRODUCTION IN THE MONTREAL MILK REGION

1929

Number of farms	226
Average acres per farm	170.60
Average acres of crops	129.45
" " of pasture	36.36
" " of woods	4.16
Number of cows	3738.
Number of cows per farm	16.54
Total pounds of milk produced	23,364,470
Pounds of milk produced per farm	103,380
Pounds of milk produced per cow	6,251
Cost of producing 100 pounds of milk	$2.703

1930

Number of farms	211
Total pounds of milk produced	22,174,700
Pounds of milk produced per farm	105,093
Pounds of milk produced per cow	6,254
Cost of producing 100 pounds of milk	$2.64

1931

Number of farms	182
Total pounds of milk produced	21,013,184
Pounds of milk produced per farm	115,457
Pounds of milk produced per cow	6,577
Cost of producing 100 pounds of milk	$2.166

The cost of producing milk in the Montreal region was started in 1929. This being a five years study we still have two years in which to continue the survey. At the end of the period we hope to find some interesting figures in connection with the Montreal milk region.

Survey No. 2

MEGANTIC COUNTY

1929

Number of farms	50
Total acres	10,754
Total crop acres	5,024.5
Average acres per farm	215.08
Average acres of crop per farm	100.49
Number of cows	569.0
Number of cows per farm	11.38
Total pounds of milk produced	3,028.846
Pounds of milk produced per farm	60,576.72
Pounds of milk produced per cow	5,332.13
Cost of producing 100 pounds of milk	$1.952
Labor income	$517.20

92% of the above farms are supplying milk to local cheese and butter factories.

"This study began in 1930 and shall continue for five consecutive years. In this survey, we also wish to determine the cost of milk production as well as labor income on these farms.

"In the study for the year 1930, we found a slight increase in the amount of milk produced, but a marked decrease in labor income and in the cost of producing 100 pounds of milk.

"Such for 1930 figures as given:—

Average number of pounds of milk produced per farm ..	72,218
Average number of pounds of milk produced per cow	5,994
Cost of producing 100 pounds of milk	$1.44
Labor income	$51.00

Survey No. 4

THE COST OF PRODUCING POTATOES

"Part of the work was undertaken during the summer of 1931. This survey included 57 farms in the potato region of the lower part of the province.

"It is the purpose of this study to find the cost factors in connection with production also to determine market costs.

"The counties included in this survey are. Matane, Rimouski, Temiscouata, Kamouraska, L'Islet.

Number of farms	57
Total acres of potatoes	418.25
Average number of acres per farm	7.33
Total yield	101,991 bushels
Average yield per acre	243.8 bushels
Average cost per bushel	26.9 cts

"The second part of the study "Marketing" being yet under way, we are unable to give the results."

CHAPTER NOTES

TORONTO

Reported by G. Alexander Phare.

Monday, May 30th, saw Toronto Chapter trying an experiment, as far as they were concerned, in that they foregathered in an afternoon of golf. One golfer, and quite a large number of players, managed to take the necessary time off; and by courtesy of Mr. Roberts, the hospitality and excellent accommodation of Lakeview Golf and Country Club was thrown open to us. We understand that the course is an excellent one, ad that although the par is 71, it has never been lowered. From a personal viewpoint we are unable to express an opinion. We brought our own tees, so the Club gets no credit for that. The greens are first class, and we found a dime on one of them. There should be more greens of this type around. The fairways look to be excellent, but very little used. The rough is full of trees, rocks, thick underbrush and old friends. We met quite a few of them, especially Mr. McKague. Dinner—quite a good one, followed the game, and our numbers were augmented by several who drove out for the latter part of the afternoon only. We regretted the enforced absence of the Chairman, Mr. Lane; and also of Mr. Spence.

Acknowledgement and appreciative thanks are due to the donors of our prize list, for there were enough prizes to supply almost everyone, whether there was any reason for their getting a prize or not. Mr. J. H. Irwin captured the low gross, and Mr. J. A. Dunlop the low net, prizes. There were other awards, notably the one for the worst score on any hole, awarded to a snappy twenty three—which the winner thereof disputed. The prizes were assorted from a selection of shaving cream from Lever Bros. Ltd; a number of flashlights, from Canadian National Carbon Co; films donated by Canadian Kodak; and chocolates by courtesy of Willard's Limited. The afternoon, although it was not as largely attended as we hope next year's will be, was a successful one. It was pleasant to see a contingent from Hamilton, with our old friend Mr. LeBrocq. Before the season closes we hope to be able to reciprocate.

HAMILTON

Reported by R. Dawson, Secretary-Treasurer.

The new executive of the Hamilton Chapter have got down to business following the close of last season and are already planning their activities in order to ensure that next season will be a banner one. First of all the executive elected the chairmen of the various sub-committees and these chairman, together with the executive committee later met and elected the complete committees. A big drive for new members is in course of preparation and it is expected that despite the trade depression, many new members will be seen at next season's meetings. The entertainment side of the chapter is not being overlooked and a good committee to look after this has been elected.

The program committee plan to make each meeting next season at which an outside speaker is heard, a dinner meeting and the attendance committee intend to appoint various team captains whose duty it will be to see that the various members turn out in force to each meeting. A new committee called the Education Committee has been appointed and special plans to aid the younger members of the chapter will be gone into during the summer months in order to have these plans completed long before the opening of next season.

Altogether the outlook for the chapter is particularly bright and the entertainment side will be well cared for with a Golf tournament later in the summer to start operations.

The personell of the various committees appointed is:—

MEMBERSHIP:— H. Wright (Chairman) A. E. Keen, R. E. Love, A. C. Wooley and R. Dawson.

ENTERTAINMENT:— C. W. Barquist (Chairman). W. Furneaux and G. Fleming.

PROGRAM:— F. Moffatt (Chairman). A. J. Ballantyne and A. E. Keen.

ATTENDANCE:—O. H. Manzel (Chairman) A. C. Fraser, G. A. Allston, S. Stott, J. Kendall and B. H. Dickson.

Education:—K. M. Horton (Chairman), M. I. Long and A. J. Mouncey.

NEW MEMBERS

The following is a new member of the Society:

Toronto Chapter

H. F. Burpee, C.A., 28 Wellington St. East, Toronto.

THE TREND OF PRODUCTION COSTS

The commodity price index compiled by the Dominion Bureau of Statistics, with 1926 as the base period, declined from 69.1 for March to 68.4 for April. Comparisons by groups are as follows:

	April 1931	March 1932	April 1932
Foods, beverages & tobacco	74.5	63.8	62.1
Other consumers' goods	80.1	78.9	78.3
All consumers' goods	77.9	72.9	71.8
Producers' equipment	90.6	90.8	90.7
Building & construction materials	83.6	79.1	78.9
Manufacturers' materials	63.1	59.6	59.2
All producers' materials	66.8	63.1	62.8
All producers' goods	69.2	65.9	65.6

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